Volume 7 January, 1921 *Number 1*

Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

Lubrication of Pulp and Paper Mill Machinery

Because of the extent and variety of operations in this industry, in the endeavor to cover the subject properly, we have devoted this entire issue to the one subject

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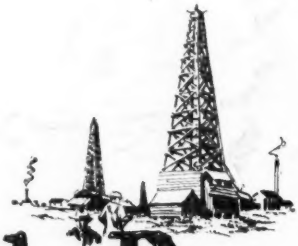

Crude Resources

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TEXACO

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Pulp and Paper Mill Lubrication

WHILE, strictly speaking, paper making cannot be designated as a modern operation, as some forms of paper have been known and used for many centuries, yet paper did not become available for its many present applications until modern machinery and chemical science had so reduced the cost of manufacture that it could be sold at a very small per cent of its former price. This reduction in cost was not attained in a short time by reason of some particular invention, but the processes now used are the culmination of much study of detail and many years of practical experience and experimentation. While the layman, who observes the operations in a paper mill for the first time, may get the impression that the machines, except the fourdrinier, are rough in design and construction and not scientifically co-ordinated, nevertheless a careful study will show the same attention to detail as is exhibited in the textile industry. As in the latter industry, the proper lubrication of machinery is acknowledged to be one of the principal determining factors in the cost of production, so in the paper industry where as a general rule storage between machines is not large and each operation is dependent on the one preceding it, it is essential that there be no break in continuity due to the incorrect lubrication of one machine or part of a machine. In discussing lubrication in a paper mill we shall outline the methods of paper manufacture, consider the types of machines found best adapted to each, and indicate the proper lubricants to be used that the machines may operate efficiently and continuously.

Modern paper making is essentially a metamorphosis of cellulose, a reduction of it from its native or original state to that of a pulp and its recombination into a more useful article, paper. Practically all material from which paper is manufactured is of vegetable origin and its useful constituent is cellulose. The value of a raw material for paper making depends on the character and quantity of cellulose it contains, and the ease with which it can be separated from the gums, salts, etc., that are not only useless and a source of trouble in the process of manufacture but may cause the production of an inferior paper. In order that paper may have the requisite strength the cellulose must be in a fibrous state, the longer the fibre the more opportunity for interlocking and the stronger the paper. The problem of the pulp maker, then, is to reduce his raw materials most economically into cellulose fibres of good length and free from harmful impurities.

The principal raw materials, now used for making pulp, are wood, rags, esparto, straw, bamboo, jute, and bagasse, though many other

materials can be used. These contain from 40% to 80% cellulose but the character and amount of pulp produced depends not only on the material but on the process of its manufacture. A large percentage of paper made in this country is produced from wood as due to the proximity of the source of supply this is found most economical to use. In some cases where special grades of paper are required, other raw materials are preferable. Of the woods, spruce and poplar are preferred as a fibre of satisfactory length and texture can be produced economically and the supply is fairly large. Woods give from 40% to 60% useful cellulose.

PULP MANUFACTURE

There are in general two methods of producing pulp from the raw material:

1. Mechanical
2. Chemical

The second method may be sub-divided into three general processes, depending on the chemicals used:

a. Sulphite
b. Soda
c. Sulphate

The mechanical method of pulp production gives the highest percentage yield from the available source of cellulose, but the fibres of the pulp are shorter and the resulting paper lacking in strength. The chemical methods produce longer fibres but there is a loss of cellulose by solution and the cost of equipment and chemicals makes the pulp more expensive than that from the mechanical process. As the advantages of chemical methods are greater than their disadvantages they are at present the predominant methods of pulp reduction. The preference of one chemical method over another is a matter of raw material and character of paper desired, and will not be considered in this article. Where low cost and quantity production are demanded a mixture of pulp from mechanical and chemical sources is generally used in order to compromise strength with cheapness.

The mechanical method of pulp manufacture when wood is used as a raw material is essentially a grinding one, the blocks of wood being held forcibly against large revolving stones.

In the sulphite process wooden chips are subjected to the action of a bisulphite of lime liquor at high temperature and pressure. This dissolves out the constituents other than cellulose.

The soda process utilizes caustic soda instead of sulphite and is particularly adapted for certain raw materials which can be more successfully treated by this method than by the sulphite process.

The sulphate process uses a combination of chemicals as sodium sulphate, sodium carbonate, sodium hydroxide and sodium sulphide in digesters similar to those used in the soda process and is particularly efficient in the production of paper where strength is the controlling characteristic. It is practically identical with the Kraft process.

In the production of pulp from other materials than wood, as rags, straw, etc., the above methods are greatly modified and generally simplified.

We shall now consider the various machines used in the production of pulp and indicate the lubricants found most efficient to use with them. We shall first consider the production of pulp from wood.

Saw Mill

Before the wood can be fed to the series of machines used in producing pulp it must be cut to such a size that it can be efficiently handled by these machines. This may be done in a saw mill near the source of supply or point of shipment, or the trimmed logs may be shipped or floated to the pulp mill and sawed there. Which procedure is most economical will depend upon the relative position of supply forest and pulp mill, and the means of transportation. In any case the process is practically the same.

The logs are of various lengths and diameters and must be cut to blocks about 2 or 4 feet long. This is done by two types of saws, called slashers and swing saws. The slashers receive the log sideways and cut it into proper lengths by a number of parallel saws an equal distance apart but set in echelon. In order to bring the

logs to these saws they are dragged up from a pond or platform by means of jack ladders or conveyors equipped with link chains. Where it is impossible to bring the logs up sideways they are brought up end to end to the slasher and then presented sideways to the saws. When logs are of very unequal lengths it is sometimes found expedient to use a swing saw and present them end to end to it. These swing saws may be either of the upper or under cut type.

From the saws the cut logs or blocks are carried by means of a chain conveyor either to cars for shipment, to the wood room of the pulp mill or to a storage pile where they are allowed to season until required by the mill.

The proper lubricant to use in the saw mill depends very largely on the construction and condition of the machines. If the bearings are close-fitting and ring oiled an oil of 200″ viscosity Saybolt at 100° F.* will be found to satisfy the condition in a large majority of the cases. If the bearings are hand oiled or fairly loose a higher viscosity, 450 to 500″, is recommended. In the case of hand oiling this higher viscosity should be used as a matter of safety as the oil will stay in place longer and there will be less danger of a hot bearing. The internal friction of the 500″ oil being greater than that of the 200″ oil, there will be some loss of power due to its use and some slight heating of the bearing manifested if it is close, but the chances of a dry bearing with hand oiling are decreased thereby and safety increased. Its use in hand oiling is therefore recommended. In some cases where the bearing is exceptionally loose it may be necessary to use a cylinder oil in order to prevent metallic contact and produce smooth running, but in such cases it is strongly recommended that the bearing be overhauled as soon as practical and a light oil used.

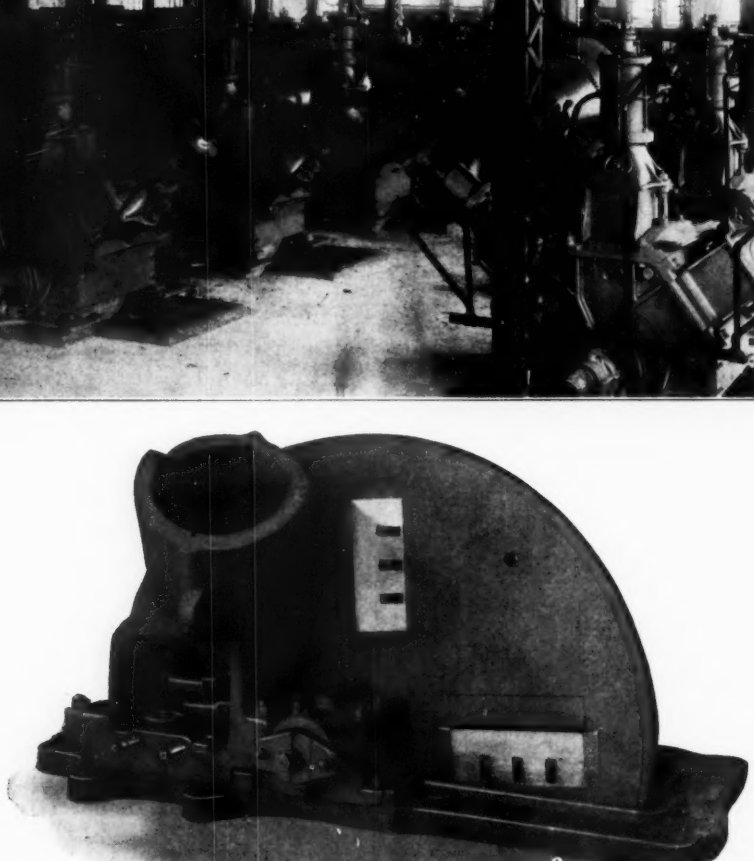
The lubrication of conveyors, jack ladders, etc., is at best an unsatisfactory proposition. Subjected to dirt, water and snow it is very difficult to keep any lubricant in the multitude of chain link bearings and rubbing surfaces. Probably the best practice is to use as heavy an oil as can be made to automatically work into the wearing surfaces at the temperature to which the conveyor is subjected. In order to withstand water conditions this oil or compound should be especially constructed to adhere to the metal in spite of the presence of moisture. Compounds are manufactured which will stay in place a long time under these conditions. These compounds may cost a little more than cheap oil but their lasting qualities more than pay for the increased cost.

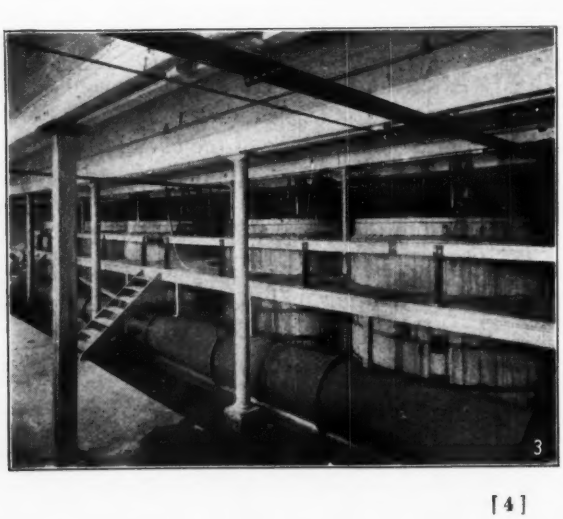
Wood Room

The cut logs or blocks are brought from the storage pile to the wood room by means of conveyors or small cars. Before they can be put through the chippers or grinders they must be cleaned of dirt and bark. This is done by means of tumbling drums or barkers. Sometimes it is thought advisable to first pass the blocks through a pond heated by exhaust steam. This not only allows the dirt and ice to wash off but also gives a storage for the various machines and assures them of running continuously. The tumbling drums are big hollow cylinders 10 feet in diameter and 25-30 feet long, containing steel bars lengthwise along the inside circumference and so arranged that in rotating the blocks fed in at one end gradually work to the other, and by contact with each other and these steel strips the bark is removed. Water is continually sprayed on the machines so as to wash away the bark and dirt. As the blocks emerge from the machines they are inspected and if the bark is not removed they are returned and sent through again. The other type of bark removing machine, called the barker, has a series of knives, somewhat similar to a carpenter's plane set in a disc, which revolves rapidly and removes the bark from the block as it is pushed against it.

After the bark is removed from the block it goes either to the ground wood mill or is broken up into chips for one of the chemical processes by means of a chipper. If the blocks are too large in diameter to be handled successfully in these machines they must first be split. Splitters may be of vertical or horizontal type and their action is simply that of driving a wedge through the block. These also may be used

**NOTE. Unless otherwise stated all viscosities in this article refer to values taken from the Saybolt Viscosimeter at 100° F. Where definite figures are given, as 200 or 500, it is not intended to infer that the viscosities should be exactly those values, but should range between 180–225 or 450–550.*





PHOTOGRAPH NO. 1
Wood Grinder. Logs are held endwise in cylinder shown against a stone revolving on a shaft.

Courtesy Pusey & Jones Co.

PHOTOGRAPH NO. 2
Chipper, with case removed to show knives.

Courtesy Carthage Machine Co.

PHOTOGRAPH NO. 3
Filtering Plant, showing agitator gears at top of vats.

Courtesy S. D. Warren Paper Co.

instead of saws in salvaging blocks that have some rot in them.

The chipper consists of a heavy disc (about 3 tons) with knives set radially on its surface. These knives are placed at such a distance from the surface that a chip about $\frac{7}{8}$" thick is cut. The block is fed against the disc and knives at an angle of about 45°. This exposes a large area of the pores of the wood to the action of the chemical. Chippers are very strongly built as they are subjected to considerable shock. The chips from the chippers are then put through a screen, which may be either a rotating drum or a horizontal shaker flat screen, which removes the knots and slivers, and also the fine material which cannot be successfully treated with the chemical. The size of the openings in the screens is approximately 1" x $1\frac{3}{4}$". The large material removed is sent to a re-chipper or to a crusher.

The crusher which runs at high speed contains a number of heavy swinging pins which are thrown out by the centrifugal force so as to crush the chips against other pins set in the housing. From the crusher the chips pass back to the screens. The accepted chips from the screens are carried by belt conveyors to storage bins placed above the digesters used in the chemical processes.

Ground Wood Mill

As previously stated the principal mechanical method of reducing wood into pulp is by means of pulp grinders. These consist of large stones about 54 inches in diameter shaped like an ordinary grindstone. Against the periphery of these stones the wooden blocks from the tumbling drums or barkers are forced end on by means of hydraulic pressure, water being played upon the stones continuously to keep them cool and to carry away the ground fibre. It is important that the speed of the wheel and pressure of the block against it be carefully regulated in order to produce the best grade of fibre. This is most satisfactorily done by means of an electrical pressure regulator.

From the pulp grinders the ground wood and water mixture is pumped or conveyed to screens which take out the slivers, knots or any material not of the proper size to go through the screen. These screens are either cylindrical or flat in construction. The revolving screens may be either horizontal or vertical centrifugals, the pulp of sufficient texture for the future processes passing through while the knots and slivers are rejected and go back to be re-ground. In the flat shaker type of screen in order that the fine holes in the wire will not become filled with fibre and also to assist the fibres through the wire, at the same time that a shaking motion is given to the screen an alternate suction and compression force is given to the liquid flowing through the holes. This is brought about by means of a rubber sheet or movable diaphragm placed beneath the screen. A number of rods called "trotters" operated by cams set out of step, pushes the diaphragm up and down rapidly and causes the alternate suction and compressive force. The liquid slurry from the screens usually has too high a percentage of water to operate satisfactorily in the beaters. It is therefore passed through pulp thickeners or separators and sometimes through wet machines or compressors. In the pulp thickeners as the liquids come in contact with a fine wire, usually on a revolving cylinder, the water either runs or is sucked through the wire to a certain extent, the fibre being scraped from the surface of the cylinder by a reed or "doctor" and conveyed to the stock chest. In the wet machine the process of removing water is carried on more completely than in the pulp thickener. Instead of removing the partly drained pulp from the cylindrical screen into the stock chest it is transferred to a felt and passes through press rolls which eliminate a large per cent of the water. It is then wound upon a roll until the desired thickness is obtained, when it is cut off into sheets of pulp about 18 x 24 inches in size. These are called laps. The pulp from the pulp thickeners or the laps from the wet machine are now ready for the beater.

Lubrication in Wood Room

The machines in the wood room require quite varied types of lubricants. The conveyors into the mill are subjected to the same conditions of water and dirt as those previously described and if lubricated efficiently must use a viscous adhesive compound which will not wash off

readily and cannot easily be worked out from between the rubbing parts. The belt conveyors carrying the chips from the wood room to the chemical room or its storage bins are generally situated in dry covered runways and the lubricants not subjected to moisture. A good grade of oil or grease, according to design of machine, is found to operate satisfactorily. As the rollers are generally hand oiled the oil should have a viscosity of 500″ in summer and 200″ in winter. An oil with a low cold test is to be preferred on account of the extremely low temperatures existing in many places where pulp mills are situated.

The tumbling drums generally ride on trunnions and are operated by means of a pinion and girth gear. These gears run open and as they are subjected to water and moisture conditions the gear compound should be very adhesive and not easily washed off. The shaft operating the pinions generally lies parallel to the drum, and water is continually flowing over it. Its bearings are hence quite difficult to lubricate and, strange as it may seem, they are not designed so as to prevent water from getting into them. Some are lubricated with grease or tallow laid on the journal of the shaft and others are hand oiled with waste as a means of holding the oil and giving it gradually to the journal. The result is that they are practically lubricated with water and they don't become hot only on account of the fact that the load is comparatively light and the water keeps them cool. The oil used should have 500″ viscosity or even be heavier bodied.

The barkers are either lubricated by means of grease cups or a good grade of machine oil is used. The viscosity of the oil should be either 200″ or 500″ depending on system of oiling, condition of bearing and the temperature.

The splitters are only used intermittently and can be lubricated with grease quite satisfactorily.

The chippers having heavy rotating parts and being subjected to heavy shocks as the knives strike the logs, should have bearings designed to hold the lubricants in place under the changes in pressure. The high speed assists in maintaining or renewing the oil film, however, so that if bearings are close fitting and ring oiled an oil having 900″ viscosity may be found satisfactory. If bearings are loose or hand oiled 500″ viscosity oil should be used and it may be even found necessary to use a cylinder oil but generally if this is necessary the bearing should be overhauled or the wheel balanced.

The bearings and eccentrics of chip screens do not present any lubricating difficulties and grease is perhaps the best lubricant to use.

The pulp grinders used in the mechanical process of reducing wood give considerable trouble in respect to lubrication due to the very heavy pressures and large amount of water present. Precautions should be taken to keep water out of the bearings but in spite of them it may get in. Some machines can be lubricated with a heavy grease or tallow if moisture is not too excessive, while if water is eliminated a heavy bodied oil of at least 500″ viscosity with wipe feed or held in waste can be used. Some operators have found these unsatisfactory on account of the water and have adopted lignum vitae bearings lubricated with water.

The pulp thickeners and wet machines can be lubricated by the general machine oil used about the mill or in some cases by grease.

The pulp screens present no particular lubrication problem except in the case of the "trotter" cams. An adhesive compound or grease which resists displacement due to shocks and sticks to the parts is recommended. It should also have moisture resisting properties as the bearing parts are not enclosed and leaks of water are prevalent. The revolving screens use the regular machine oil employed in the mill, or grease.

Rag Reduction

We have above described the methods of obtaining pulp from wood. The most important source of pulp outside of wood is rags. Rags give a very high yield of useful fibre and are particularly adapted for special forms of high grade paper. The raw material comes to the mill in such shape that it usually has first to be sorted before being sent to the machines for reduction to fibre. The rags then pass through dusters or "willows" and thrashers where they are given a thorough beating and breaking apart, and extraneous material, such as but-

tons, hooks, etc., are removed. The material from the thrasher then passes through cutters which are a series of revolving knives that cut the material into fine pieces. It is then passed into steel drums where it is boiled and digested to remove dye, grease, etc., and to reduce the fibre to the consistency of pulp. After the boiling process is completed the rags are thoroughly washed and are ready to pass to the beater.

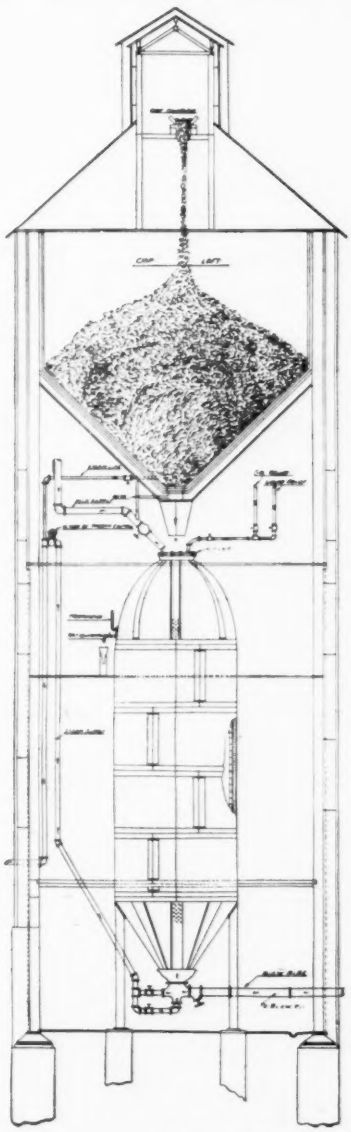
Materials other than wood and rags, as for instance, waste paper, jute, bagasse, etc., can be reduced to fibre by more or less similar processes but the difference is more a matter of detail than of principle, and we shall not take them up in this article. The same principles of lubrication apply in these cases as are indicated for the machines specified in the article.

The dusters, willows, rag cutters, etc., used in the rag paper industry may be lubricated with general machine oil used about the mill. As most of the bearings are hand oiled the oil should have a viscosity of about 500″. Some machines are equipped with grease cups in which case a heavy bodied grease should be used.

Chemical Mill

The chips from the wood chipper which are to be treated with chemicals are stored in hoppers above the digesters where the chemical action is to take place. The most important chemical process now in use in this country is known as the sulphite process. In this the chips are run from the hopper into digesters placed beneath. The chemical is then run into the digesters and the whole heated by steam either directly or indirectly. The digesters must be lined with lead or some other material which resists the action of the acid liquid. In the case of direct steam heating the steam is blown in at the bottom until the pressure and temperature required are reached. In the indirect method the digester is surrounded by a steam jacket which is kept at the proper temperature for digestion. In another method of heating the liquor is continually forced through the chips, it being heated in a heater separate from the digester. After the chips have been cooked the required time and are in a fibrous condition they are blown into a pit and drained of the liquor. The fibre is then washed several times with water and passed through screens similar to those described above where knots and undigested chips are removed. From the screens the fibre goes through pulp thickeners or wet machines as previously narrated.

In the soda and sulphate processes the action is more or less similar except different chemicals



Courtesy of The Chemical Catalog Co.

DIAGRAM OF SULPHITE PULP DIGESTER

The chips and liquor are admitted at top and pulp is blown into a pit from the bottom when sufficiently cooked.

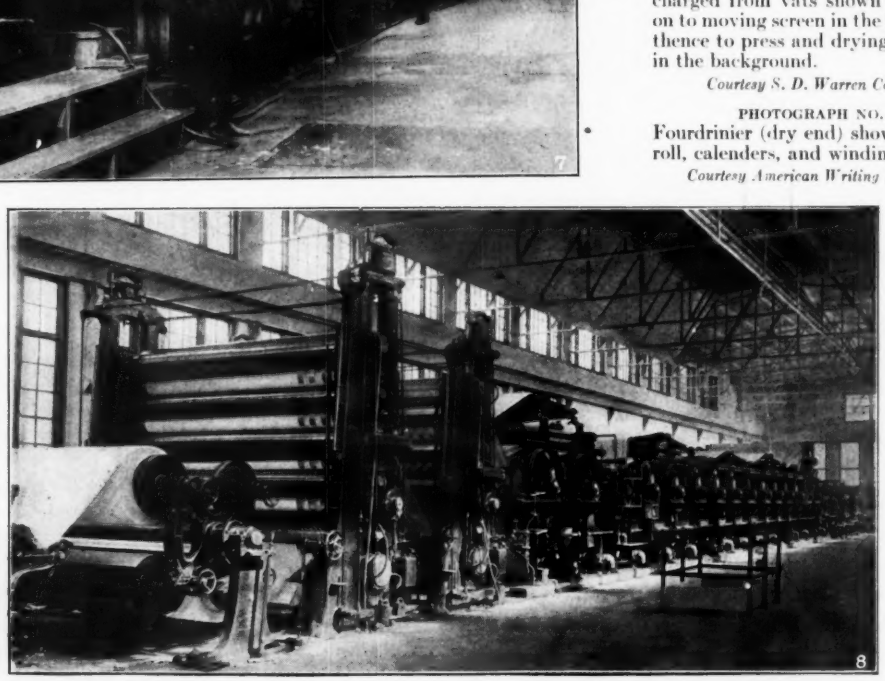
PHOTOGRAPH NO. 4
Rag Cutter.
Courtesy American Writing Paper Co.

PHOTOGRAPH NO. 5
Beaters. The sizing and loading material is here mixed with the pulp.
Courtesy American Writing Paper Co.

PHOTOGRAPH NO. 6
Jordan Engine. Pulp here receives its final refining before passing to the paper machine.
Courtesy American Writing Paper Co.

PHOTOGRAPH NO. 7
Fourdrinier (wet end). Pulp is discharged from vats shown on the left on to moving screen in the foreground, thence to press and drying roll shown in the background.
Courtesy S. D. Warren Company

PHOTOGRAPH NO. 8
Fourdrinier (dry end) showing drying roll, calenders, and winding reel.
Courtesy American Writing Paper Co.



and a different form of digester may be used. In these cases, as there is no action of the chemicals against iron, steel drums can be used as digesters.

In the soda and sulphate processes the controlling factor in efficiency operation is the recovery of the waste liquors, as the chemicals are expensive and are not entirely consumed in the process. The pulp mass from the digesters is leached with water which by being passed through several batches in succession has its concentration of chemical made high and thus expense of evaporation is reduced. The waste liquor is then evaporated to a molasses consistency and burned in rotary kilns or calciners. It is then further treated with chemicals and brought up to the required chemical strength for the digesters. Outside of the pumps the only machine which requires special mention in regard to lubrication is the calciner. These are operated by pinions and girth gears which become quite hot. A special gear compound is necessary which will stick to the gears, not drip off and still lubricate at the high temperature to which the gears are subjected.

PAPER MILL

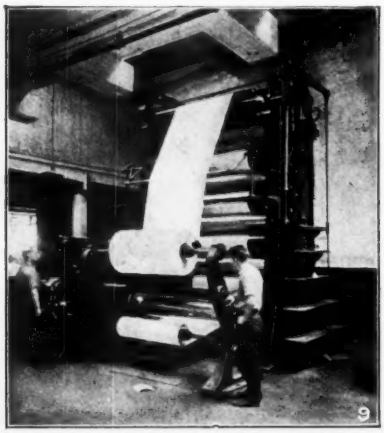
Beater Room

We have up to this time considered only the reduction of the various raw materials to pulp. We shall now take up the manufacture of paper from the pulp. Before this can take place, however, the pulp must pass through large vats where it is bleached and then passed to the stock chest. The material in the bleaching vats must be agitated and the only lubricating problem is that of the gears which must have a gear compound which resists moisture. The first machine to receive the pulp from the stock chest or from the laps is the beater. This consists of an oval-shaped tank about 25 feet long and 11 feet wide. In the center of the tank or tub is a vertical partition or midfeather which terminates about three feet from each end of the tub. On one side of the tank, filling the space between the midfeather and the wall, is a cylindrical beater roll. This roll, which is very heavy, is equipped on the surface with a number of steel bars about ¼ to ½ inch thick, running parallel to the shaft of the roll. The roll revolves directly over a set of parallel blades called the bed plate, and may be made to approach or recede from these blades according to the fineness of the fibre desired. These steel bars are sufficiently dull so as not to cut the fibre and yet to beat the pulp apart when it is passed between the roll and the bed plate. Into the beater is fed the material from the stock chest, together with such proportions of other material, as clay, size, etc., as may be necessary for the grade of paper desired. The function of the beater is to thoroughly mix the various ingredients of the paper stock and to beat the fibres apart and to the proper length. This is largely controlled by the pressure between the beater roll and the bed plate.

As the ground wood pulp and chemical pulp are quite different in texture they cannot be beaten simultaneously in the same beater. Different types of pulp are therefore prepared in separate beaters and receive their final mixing in a stock chest placed beneath the floor of the beater room.

As previously stated the beater roll is very heavy, weighing several tons, and generally has a cast iron journal. It also is often subjected to a lifting pressure due to masses of unseparated pulp becoming wedged between the roll blades and the bed plate. To accommodate this action the top part of the bearing is often left open and the roll in action is lifted out of its bearing and dropped back suddenly into it. When this takes place a mass of pulp and water may be thrown into the bearing. This makes the lubrication of the beater a difficult proposition. Whatever lubricant is used must be heavy bodied so as not to be readily squeezed out by the weight and impact. Some beaters use a heavy grease laid on the journal while others use waste soaked in an oil of 500″ viscosity or even a cylinder oil. Precaution should be taken to keep the pulp out of the bearing.

Some beaters have water cooled bearings and bearing caps to resist the lifting action and are ring oiled. In this case an oil of 500″ viscosity may be used, depending on temperature.



PHOTOGRAPH NO. 9
Close-up of calender.
Courtesy S. D. Warren Company

PHOTOGRAPH NO. 10
Rotary Cutters. Taking paper from roll and cutting into sheets of proper size.
Courtesy S. D. Warren Company

PHOTOGRAPH NO. 11
Sorting and Counting Room. Paper is here given final inspection before passing to the packing room.
Courtesy S. D. Warren Company

From the stock chest the mixed paper stock is usually run through a final refining process in a machine known as a Jordan engine. This consists of two concentric cones equipped with knives on their contact surfaces, the inner cone revolving against the outer at such a distance from it as to give the proper character to the stock.

Considerable heat is generated in the Jordan but the bearings are usually water cooled so that the regular machine oil of 200″ or 500″ viscosity may be used, depending on type of oiling system. In some cases, if bearings are loose, a cylinder oil is necessary. Much trouble is caused in Jordan engine bearings by the driving belt becoming wet and too tight.

There are other types of refining engines but as they are not in general use we shall not consider them at this time.

Machine Room

Without doubt the most interesting piece of apparatus in the manufacture of paper is the fourdrinier or paper machine. This takes the pulp mixed with a large amount of water at one end and gives it up as finished paper at the other end. If everything is running smoothly the only attention necessary is to take away the rolls of paper from the exit end of the machine. The pulp-water mixture at the wet end of the machine flows onto a horizontal wire screen which is made in the form of an endless belt and is traveling constantly away from the point where the pulp flows onto it. This belt is given a shaking motion in order to assist in matting the fibres. The water in the pulp, assisted by suction boxes under the wire, drains away from the stock to a considerable extent until at the lower end of the wire belt sufficient water has been removed so that the sheet of resultant fibre has enough strength that it can be taken off continuously onto an endless felt belt which carries it through several pairs of rolls where more moisture is pressed from the film of fibres. The sheet from the felt belt is then carried successively through a series of steam-heated rolls geared together, where the moisture is practically driven from the sheet and it becomes paper. At the lower end of the paper machine, the paper passes through calender rolls revolving at different speeds which polishes it to the desired surface. It is then rolled up onto big cylinders and is either ready for the market or for such further coating or cutting as may be necessary, depending on the character of the paper being produced.

Before passing the pulp stock into the paper machine it is generally given a final screening to be sure that the proper material is fed to the machine. These screens operate similar to those previously described.

The correct lubrication of the fourdrinier is most important. This machine involves a number of successive operations which must take place exactly and on time. The failure of one part may stop the whole system. The drying rolls are geared together so as to assure of their running in synchronism. The wet end of the machine, however, may be adjusted in speed and feed according to the weight and character of the paper desired.

The screens on the wet end are lubricated in a similar manner to those placed after the pulp grinders. The bearings carrying the operating mechanism of the endless wire belt, upon which the pulp first flows, are quite difficult to lubricate on account of the water running over them. It is usually considered the best practice to use a heavy bodied grease, especially designed for the conditions, which will stick to the journals in spite of moisture; otherwise it may result simply in water lubrication. The loads are not heavy, except in the case of press rolls which generally have ring oiled bearings, and the problem may not become serious, but in many cases more attention should be given to shedding water from these bearings.

The bearings holding the drying rolls which are quite heavy, are subjected to considerable heat from the steam admitted to the rolls for drying the paper. This necessitates that particular attention be given to the viscosity of the oil at the operating temperature. At present there seems to be no standardization and several types of oiling systems are used on these machines. Those equipped for grease should use a compound especially adapted to them. If ring oiling or some similar method of continuous feed is used a heavy bodied oil or cylinder oil is found most economical. Many

operators prefer a wipe feed cloth fed from a reservoir by wicks while others use waste soaked in the oil but in any case care must be taken that there always is a film of oil around the journal. Whatever oil is used should not break down on account of the heat. The gears on the rolls should be lubricated with a grease that will not run or throw when hot.

Calenders are usually ring or similarly oiled and as the pressures may be high an oil of 500″ viscosity or a cylinder oil is recommended. The reels and winders are not subjected to heavy pressure and can be successfully lubricated with an oil of 200″ viscosity.

Although we now have paper the process is not necessarily completed. Some papers must be coated and dried and others given the particular finishes required by the consumer. There are a variety of machines used for this purpose but as a rule the regular machine oil of 200″ or 500″ viscosity will take care of them.

After the paper is finally complete it must pass through a series of cutters and perhaps folders during which process it is carefully inspected for any defects. It is then boxed for shipment. Many plants have their own box manufacturing plants, the lubrication of which is similar to that outlined previously for the saw mill.

GENERAL PLANT LUBRICATION

In addition to the machines enumerated above there are a number of auxiliaries which should be considered. Many plants, operated by steam, have steam turbines and steam engines. Turbines should use an oil especially refined as to non-emulsifying properties, of about 180″ to 200″ viscosity, as the general machine oil of 200″ viscosity is not usually suitable for this purpose. This 180″ oil is also suitable for centrifugal pumps and other high speed apparatus. In variable speed and other steam engines the cylinder oil should be slightly compounded if the exhaust steam is not to be used in the rolls. In the latter case, however, no compound should be used. This also applies to steam pumps and to such emergency steam apparatus as it may be found necessary to maintain. A more detailed discussion of both steam turbine and steam cylinder lubrication will appear in a later issue of Lubrication.

Shafting, as a general rule, is hand oiled or is equipped with grease cups. If hand oiled, a 500″ viscosity oil should be used while if sight feed cups or other automatic methods are installed a lighter oil of 200″ viscosity can be used.

SUMMARY

In the foregoing article we have outlined in a general way the lubricants to use on the various machines used in the pulp and paper industry. When it is considered that under each type of machine there may be many styles and each style may have a different lubricating system, it is seen that it is impossible to lay down a definite rule in each case. The specific conditions about the mill and the temperature under which the machines operate also affect to a large extent the type or viscosity of lubricant to use. In some cases opinions may differ as to just the viscosity of oil to use. We have tried to limit the number of oils required in a mill, as we believe the conditions of running introduce more variations in fluid friction than exist between two oils of slightly different viscosity. It is to be regretted that so many bearings in the industry are not designed to meet water conditions in the most satisfactory manner. This often leads to blame being attributed to the lubricant when it should be attached to the bearing designer who did not consult the lubricating engineer in designing his machine. Under these conditions if the lubricants enumerated above do not seem to give entire satisfaction it is recommended that a lubrication engineer of a reliable company be consulted, as his experience or that of his company is probably broad and much time and expense can be saved by utilizing it to the fullest extent.

EDGAR C. RUWE CO., INC.
Printing
47 West Street, New York City

TEXACO LUBRICANTS for the PAPER INDUSTRY

IN this list endeavor is made to keep the number of kinds of lubricants required as low as possible.

As, many factors may have a bearing on the selection, two lubricants are generally recommended. The one marked "Minimum" is to be used in case there is an automatic oiling system, as rings, chains, wipe feed, oilers, etc., and where the bearings are close fitting. This also applies in cold weather. The brand under "Maximum" should be used if bearings are worn or loose, or if hand oiling is used. This also applies in hot weather.

	Minimum	*Maximum*
SAW MILL		
Slashers	TEXACO NABOB OIL	TEXACO ALTAIR OIL
Swing Saws	TEXACO NABOB OIL	TEXACO ALTAIR OIL
Log Conveyors	TEXACO CRATER COMPOUND No. 1	
PULP MILL		
Log Conveyors	TEXACO CRATER COMPOUND No. 1	
Tumbling Drums *Bearings*	TEXACO No. 3 GREASE	
Gears	TEXACO CRATER COMPOUND No. 1	
Barker	TEXACO NABOB OIL	TEXACO ALTAIR OIL
Splitter	TEXACO No. 3 GREASE	
Chipper	TEXACO NABOB OIL	TEXACO ALTAIR OIL
Chip Screens	TEXACO No. 3 GREASE	
Crusher	TEXACO NABOB OIL	TEXACO ALTAIR OIL
Pulp Grinder		
Protected Bearings	TEXACO NABOB OIL	TEXACO ALTAIR OIL
Partially Protected Bearings	TEXACO ALTAIR OIL	TEXACO PINNACLE CYL. OR TEXACO PAPER MILL GREASE
Lignum Vitae Bearings	WATER	
Pulp Screens *Bearings*	TEXACO No. 3 GREASE	
Cams	TEXACO CRATER COMPOUND No. 1	
Calciner	TEXACO CRATER COMPOUND No. 1	
Vacuum Pumps	TEXACO NABOB OIL	TEXACO ALTAIR OIL
Pulp Thickener	TEXACO NABOB OIL	TEXACO ALTAIR OIL
Wet Machines	TEXACO NABOB OIL	TEXACO ALTAIR OIL
PAPER MILL		
Beaters	TEXACO ALTAIR OIL	TEXACO PINNACLE CYL. OIL
	TEXACO PAPER MILL GREASE	
Jordans	TEXACO NABOB OIL	TEXACO ALTAIR OIL
Fourdrinier— *Wet End*	TEXACO PAPER MILL GREASE	
Dry End	TEXACO ALTAIR OIL	TEXACO PINNACLE CYL. OIL
Calenders	TEXACO NABOB OIL	TEXACO ALTAIR OIL
Cutters and Folders	TEXACO NABOB OIL	TEXACO ALTAIR OIL
POWER PLANT		
Shafting	TEXACO NABOB OIL	TEXACO ALTAIR OIL
Turbines	TEXACO REGAL OIL	
Centrifugal Pumps	TEXACO REGAL OR NABOB OIL	
Steam Pumps	TEXACO PINNACLE CYLINDER OIL	
Steam Engine		
Steam End	TEXACO PINNACLE CYLINDER OIL	
Bearings, Etc.	TEXACO REGAL OIL (*if circulating*)	
	TEXACO ALTAIR OIL (*if non-circulating*)	
Rotary Converters	TEXACO REGAL OIL	
Gears	TEXACO CRATER COMPOUND No. 1	

If the grade of oil to use for any specific machine or part is not covered in the above list, kindly call on us and we shall be glad to tell you which is the right oil for the right place.

THE TEXAS COMPANY, Dept. H., 17 Battery Pl., New York City

When You Are Out on the Road —Miles Away From Anywhere— And Your Engine Heats Up

You get out and look at the radiator—
And you find the water level is OK—
You look at your oil gauge—
And that shows where the trouble is—
What do you do?

?

Do you risk it?—and run your car any way—
Or do you get out and trudge along through the mud or dust?—
(One or the other seems to be present when you are in this fix)
To the next place where they sell oil—
And take the kind of oil they give you—
Walk back and fill your car—
And then go on, worrying about what this oil might do to your engine—

* * *

Or are you on to the Texaco Easy Pour Can—
And have you learned the value of having one of these with you all the time—
So that when you need oil you just step out and lift the hood—
Screw the cap off this handy can—
Punch the seal that guarantees pure, high-grade TEXACO MOTOR OIL—
Put the nozzle into the breather tube opening which it reaches so easily—
And pour out the contents—
Snap back the hood—
Sit down behind the wheel—
And drive on, knowing that your engine is protected from friction and over-heating—
And comfortable in the knowledge that you have not spilled oil over your hands or your clothes—
And have not had the bother of stowing away a greasy can or an oily funnel.
If you have been through this, you will agree that it pays—
To hunt up a dealer who sells the Texaco Two Quart Easy Pour Can and get several of them—
So that you are sure to have clean, fresh oil when you need it most.

Keep an Easy Pour Can in your car always. It stows away like a thermos bottle.

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